(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 722 197 A2

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
17.07.1996 Bulletin 1996/29

(51) Int. Cl.[6]: **H01R 4/24**

(21) Application number: **95119813.4**

(22) Date of filing: **15.12.1995**

(84) Designated Contracting States:
DE ES FR GB IT SE

(30) Priority: **16.01.1995 GB 9500782**

(71) Applicant: **THE WHITAKER CORPORATION**
Wilmington, Delaware 19808 (US)

(72) Inventors:
- **Hotea, Gheorghe**
  D-64347 Griesheim (DE)
- **Wittig, Lutz**
  D-63225 Langen (DE)

(74) Representative: **Heinz-Schäfer, Marion**
AMP International Enterprises Limited
Ampèrestrasse 3
9323 Steinach (SG) (CH)

(54) Insulation displacement contact for multiple wire sizes

(57) An electrical connector assembly comprising an electrical terminal (2) seated within a housing (60), said terminal (2) including an insulation displacement contact (IDC) section (6) adapted for receiving a multitude of through wire diameters along the length thereof and a conductor engaging section (4) for electrical engagement with a mating wire end (8) where said assembly has a first position (Figure 5) with the terminal (6) in the housing (60) and the IDC section (6) is open for engaging the wire along the length thereof.

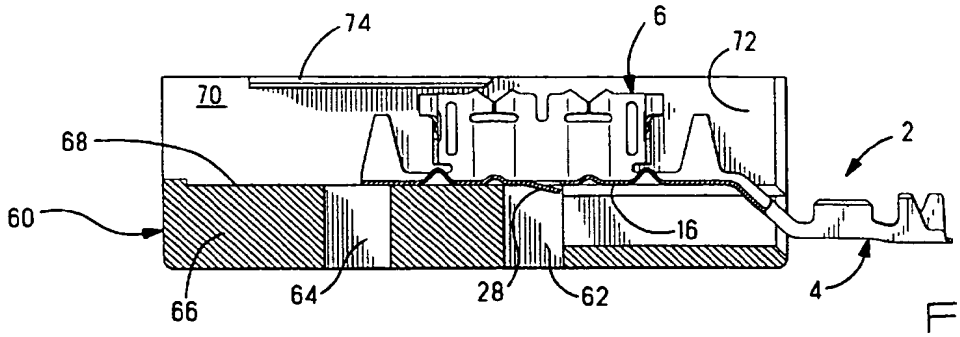

Fig. 5

EP 0 722 197 A2

Description

This invention relates to an electrical tap connector having insulation displacement contact having multiple aligned insulation displacement contact (IDC) sections.

There are may applications where it would be desirable to provide IDC termination technology. However, one drawback to IDC contacts is that they are very sensitive to the cross-sectional size of the insulated conductor to be inserted therein. As it is occasionally unknown what the actual wire size is that needs to be terminated, it has been difficult to incorporate IDC structure where its application may be most advantageous, such as where a simple termination is required. One particular example would be where it is necessary to splice/tap a through lead of a wire harness in a vehicle to provide power for some type of accessory. It would be very helpful to be able to use IDC technology rather than require cutting and crimping that may require the services of a skilled installer.

The reason IDC structure is so sensitive to cross-sectional size is that the cutting edge that pierces the insulation must fully expose the internal conductor while not causing damage to the conductor by over-cutting which would produce detrimental results especially where stranded conductive cores are used. Additionally, the contacting portions of an IDC must be positioned close enough to each other to engage the conductive core while still retaining some resilience so that a durable and reliable connection may be made and maintained.

It is an object of this invention to provide a tap connector for making an electrical tap connection between a through wire and a tap wire where the through wire is engaged in an IDC manner.

It is another object of this invention to provide a tap connector assembly having an IDC section adapted to operably receive one of a wide range of insulated conductors along a common axis.

These objects are accomplished by providing an electrical connector assembly comprising an electrical terminal seated within a housing, said terminal including an IDC section adapted for receiving a multitude of through wire diameters along the length thereof and a conductor engaging section for electrical engagement with a mating wire end where said assembly has a first position (Figure 5) with the terminal in the housing and the IDC section is open for engaging the wire along the length thereof.

In another aspect of this invention, an IDC section is provided comprising a first IDC for receiving larger size conductors and a second IDC for receiving smaller sized conductors wherein each IDC includes opposing members having opposing cutting portions followed by opposing contacting portions characterized in that the first IDC and the second IDC are axially aligned and the opposing members of the second IDC include soft shoulders preceding the cutting portion in the direction of insertion of the insulated conductor whereupon when a larger sized conductor is being placed within contact section the first IDC cooperates with the soft shoulders to splay the opposing members of the second IDC such that the insulation upon the conductor is not pierced through to the conductor core by the cutting portions of the second IDC.

It is an advantage of this invention that it provides a splice/tap terminal wherein an additional conductor engaging portion is included to engage a complementary component while the IDC section engages along the length of one of a desired through conductor of a wiring harness. It is still another advantage of this invention that a housing may be provided for the splice/tab terminal wherein the terminal has a first position with the second conductor engaging contact exposed from the housing for ease of mating and a second position wherein the IDC section is fully disposed within the housing and thereby supported for termination with the mating through conductor.

It is an advantage of this invention that IDC technology may be provided in an IDC section for receiving insulated conductors over a wide cross-sectional size range. It is another advantage of this invention that by aligning a first IDC and a second IDC along a common axis, the width of the contact section is minimized. It is yet another advantage of this invention that by providing soft shoulders above the cutting portions of the second IDC, the opposing members forming the second IDC may be deflected out of the way so as not to engage the conductor of the larger conductors that may be inserted into the contact section.

The invention will now be described by way of example with the following figures, wherein;

Figure 1 is a top view of a splice/tap electrical terminal 2 according to the present invention;
Figure 2 is a side partial section view of the electrical terminal of Figure 1;
Figure 3 is a simplified sectional view of the electrical terminal of Figure 1 taken along lines 3-3;
Figure 4 is a simplified sectional view of the electrical terminal taken along lines 4-4;
Figure 5 is a side sectional view of the electrical terminal of Figure 1 disposed in a first position within a housing; and
Figure 6 is a side sectional view of Figure 5 showing the electrical terminal in a second position.

With reference first to Figures 1-4, a splice/tap terminal incorporating an IDC contact section according to the present invention is shown generally at 2. The splice/tap terminal 2 includes a conductor engaging section 4 and an IDC section 6. The conductor engaging portion 4 is adapted for a crimp-type electrical engagement of an end of a conductor 8 having insulation 10 surrounding a conductive core 12, as seen in Figure 6. The conductor engaging section 4 shown in the drawings is commonly referred to as a F-crimp design. However, it is important to note that the conductor engaging portion 4 may take on any number of other configurations, such as an IDC section or a complementary contact that will

engage a mating terminal. The conductor receiving region 4 is connected to the IDC section by way of a transition section 14.

The IDC section 6 is formed of opposing walls 16,18 which carry a pair of first IDCs 20 located between a pair of second IDCs 22. The first IDCs 20 are configured for engaging a larger insulated conductor (not shown), which in this embodiment would fall within the range of 0.75-1.0mm^2. The second IDCs 22 are configured to engage the smaller insulated conductor (not shown), which in the embodiment shown would include wires within the range of 0.35-0.5mm^2. The first IDC 20 and the second IDC 22 are axially aligned along axis 24.

The IDC section 6 includes a base 26 integrally formed with the sides 16,18 to form a U-shaped cross-section open in the direction of insertion of the insulated through conductors. The base 26 extends the length of the terminal 2 and at the contact section 6 includes a locking lance 28 for positioning the terminal 2 within a housing as will be described below. Outward of the first and second IDC 20,22 are strain relief sections 30. The strain relief sections 30 include upwardly standing arms 32 that are crimpable upon the insulated conductor (not shown) when placed in the IDC section 6 to provide strain relief in order to assure a durable interconnection that is maintained by preventing the conductor from being displaced therefrom. The first IDC includes opposing V-shaped members 34 having upper cutting arms 36 separated at the point of intersection and being partially undercut along their length. At the free ends of the arms 36 are corners 38 that pierce through the insulation surrounding a conductor to expose the conductive core. Below (referring only to the direction of insertion of the insulated conductor)the cutting arms 36 are contacting portions 40 which are similarly V-shaped where the apex is blended with a radius which will engage against the exposed conductor once the insulated conductor is inserted therein. IDC sections of this type are well known in the industry and have been successfully used by the assignee of this invention in numerous commercial products.

The second IDC 22 is located on either side of the first IDCs 20. The second IDCs 22 are formed at the free ends 42,44 of side walls 16,18 respectively. The second IDCs 22 include a soft edge 46 followed by cutting edges 48 and finally contacting surfaces 50. The soft portions 46 are curved and flattened surfaces that provide a soft edge such that as the larger insulated conductors are inserted into the IDC section 2, the insulation thereupon comes into contact with the surfaces 46 and splays the free ends 42,44 apart so that the cutting edges 48 do not pierce the insulation through to the conductive core.

As best seen in Figure 2, the opposing members that make up the second IDCs 22 are formed integrally with and folded inwardly from the respective side walls 16,18. The opposing members are separated towards the base 26 by a longitudinally extending undercut 52. The undercut 52 forms wing portions 53 that are deflectable along the wall 16 without adversely affecting the position of the first IDC 20 so that a larger insulated conductor may be inserted. Slot 54 is provided to further improve the deflection characteristics. When a small cross section insulated conductor is inserted into the contact section 6, the insulation thereupon clears the soft edges 46 and are received directly by the cutting edges 48 which split the insulation and expose the core for engagement by the contacting surfaces 50. The cutting arms 36 may slightly bite into the insulation but will not expose the core.

With reference now also to Figures 5 and 6, the electrical terminal 2 described above but not limited thereto is shown incorporated into a housing 60. The housing 60 provides a preloaded position as shown in figure 5 where the locking lance 28 of the terminal 2 is set within a first cavity 62, thereby preventing the terminal 2 from being withdrawn therefrom. As best seen in Figure 6, the housing 60 further provides a loaded position where the locking lance 28 is received within a second cavity 64. This structure enables a compact design where the conductor receiving section 4 is exposed for mating and then the terminal is recessable within the housing 60 so that the contact section 4 may be fully supported during the IDC termination along an insulated conductor (not shown) by a stuffer mechanism (also not shown).

The housing 60 includes a base 66 that defines a shelf 68 upon which the base 16 of the IDC section is disposed. A pair of opposing walls 70 extend upward from the base 66 in a U-shaped manner to define a terminal receiving region 72 therebetween. Each wall 70 includes a rib 74 that extends into the receiving channel 72 to overlie a portion of the side walls 16,18 of the IDC section 6 so that the terminal 2 is prevented from being withdrawn outward therefrom and the ribs 74 leave a sufficient amount of first and second IDCs 20,22 exposed for receiving the conductive lead (not shown) therein. Once the tap wire 8 has been disposed within the conductor receiving end 4, the terminal 2 can be moved into its loaded position (Figure 6) and the mating lead may be stuffed into the IDC section 6 afterwhich the strain reliefs 30 may be crimped thereabout.

Advantageously then a tap connector assembly is provided for engaging along the length of a through conductor where the assembly has a first position for connecting to the tap wire and a second position for engaging the through wire and the contact therein has multiple IDC sections for engaging different size through wires. In addition, the IDC sections can be aligned along a common axis thereby reducing the width of the assembly. One of the IDC sections adapted to engage a smaller through wire includes a soft shoulder to cooperate with the larger through conductor in order to splay the opposing sides of the smaller IDC.

Claims

1. An electrical connector assembly comprising an electrical terminal (2) seated within a housing (60), said terminal (2) including an insulation displace-

ment contact (IDC) section (6) adapted for receiving a multitude of through wire diameters along the length thereof and a conductor engaging section (4) for electrical engagement with a mating wire end (8) where said assembly has a first position (Figure 5) with the terminal (6) in the housing (60) and the IDC section (6) is open for engaging the wire along the length thereof.

2. The electrical connector assembly of claim 1, wherein the housing (60) includes an open topped channel (72) wherein the IDC section (6) is disposed in the second position with a base (66) with a pair of cavities (62,64) therein and said terminal (2) includes a locking lance (28) for establishing the first and second positions through cooperation with the cavities (62,64).

3. The electrical connector assembly of claim 2, wherein a rib (74) is formed along the channel (72) to prevent the terminal (2) from being removed therefrom.

4. The electrical connector assembly of claim 3, wherein the terminal (2) includes strain relief sections (30) on either side of the IDC section (6) for gripping the through wire.

5. The electrical connector assembly of any one of claims 1-4, wherein the IDC section (6) includes a first IDC (20) for large conductors and a second IDC (22) for smaller conductors wherein each IDC (20,22) includes opposing members having cutting portions for cutting the insulation of the respective conductor and contacting portions for engaging the conductive core thereof, where the first and second IDC sections (20,22) are aligned along a common axis (24).

6. The electrical connector assembly of claim 5, wherein the opposing members of the second IDC (22) include soft shoulders (46) above the cutting portions (48) such that when the large conductor is pressed into the first IDC (20) the soft shoulders (46) and large conductor cooperate to splay the opposing arms (42,44) of the second IDC (22) so as not to cut through the insulation thereof and expose the conductor therein.

7. The electrical connector assembly of claim 6, wherein the IDC section (6) includes a pair of first IDC sections (20) and a pair of second IDC sections (22).

8. The electrical connector assembly of claim 7, wherein the conductor engaging section (4) is a crimp connector.

9. The electrical connector assembly of claim 8, wherein the IDC section if formed in a U-shaped manner having opposing sides (16,18) extending upwards from a base (26) where the opposing members for each (IDC) section (20,22) are formed from the opposing sides (16,18).

10. The electrical connector assembly of claim 9, wherein the opposing members (42,44) of the second IDC (22) are separated from the base (26) by an undercut (52).

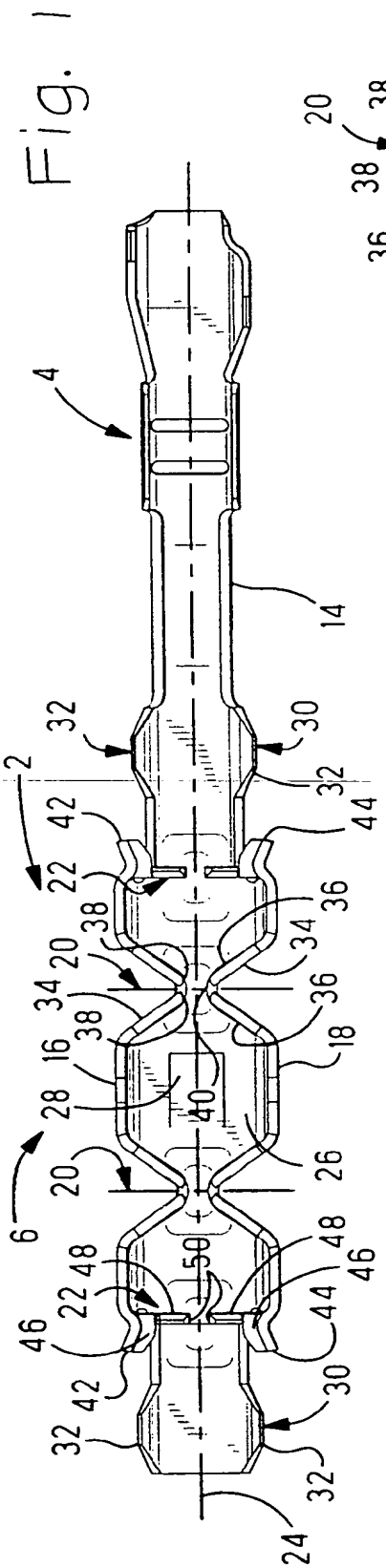

Fig. 1

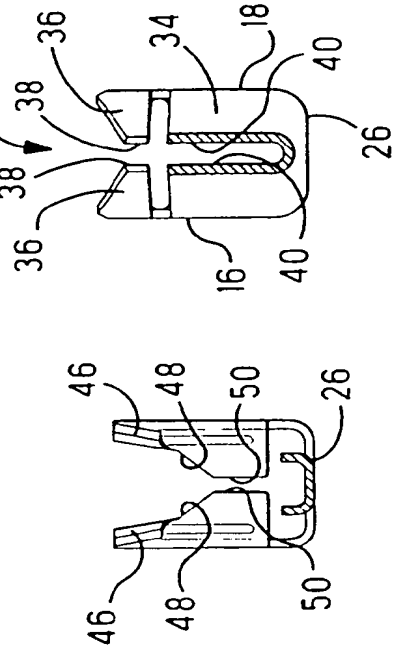

Fig. 3

Fig. 4

Fig. 2

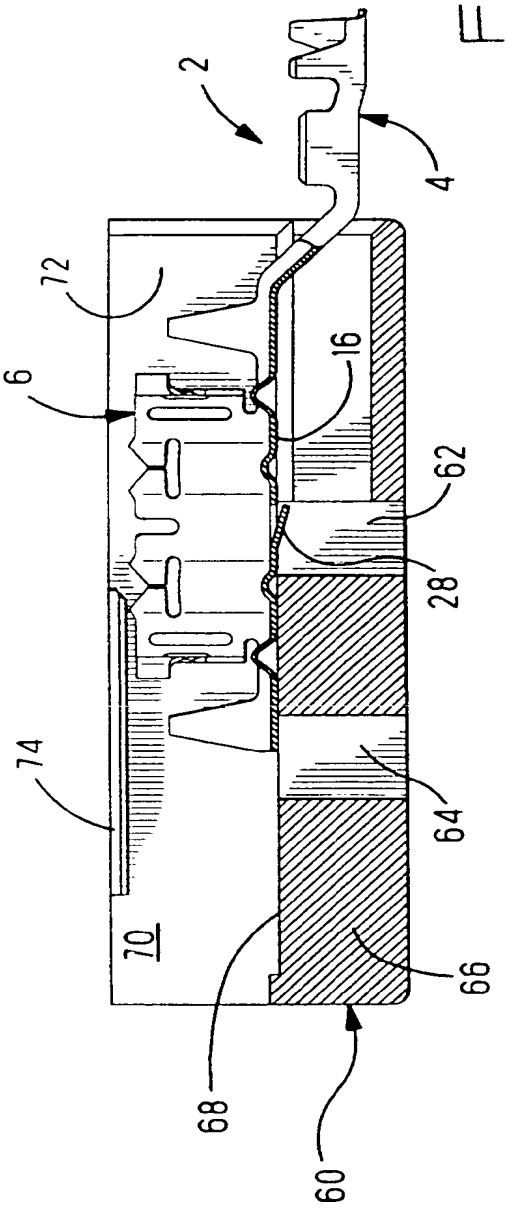

Fig. 5

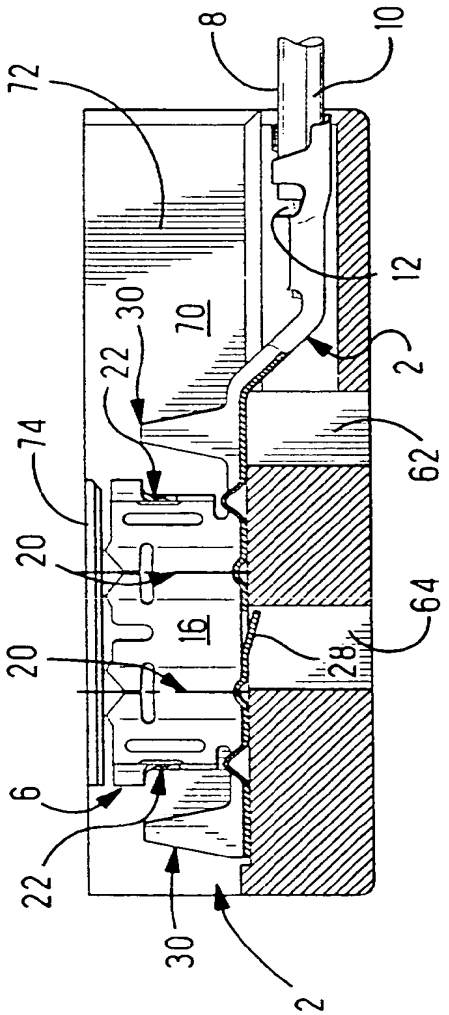

Fig. 6

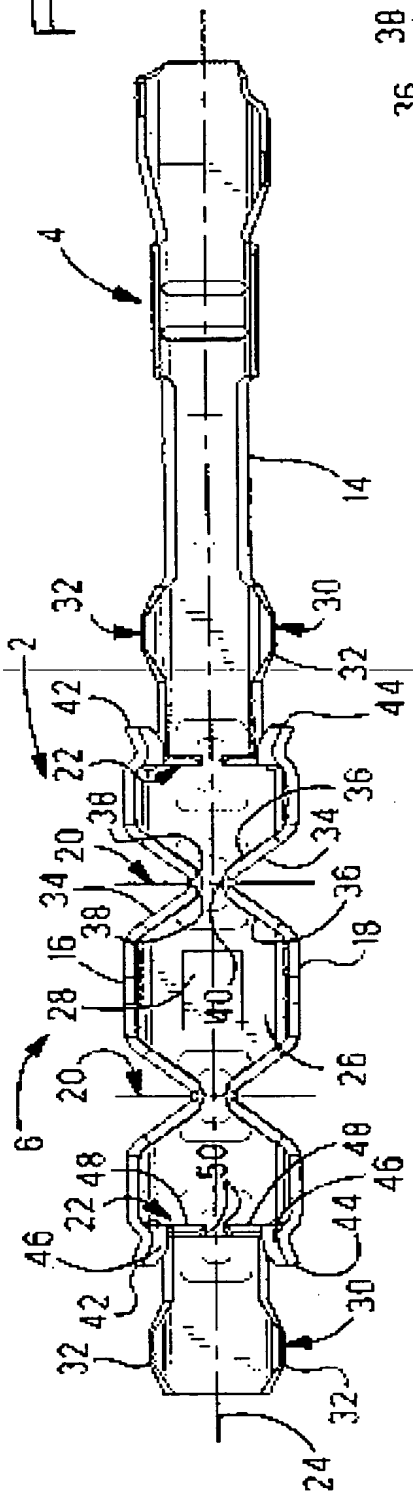

Fig. 1

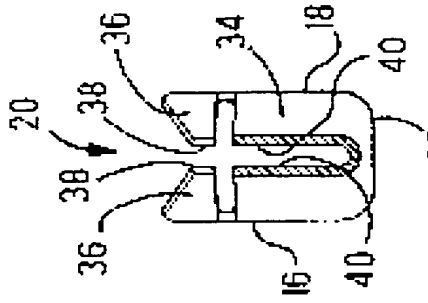

Fig. 3

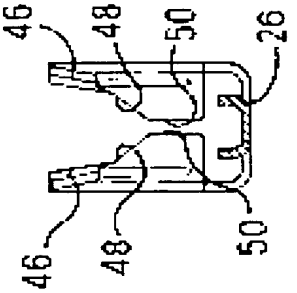

Fig. 4

Fig. 2

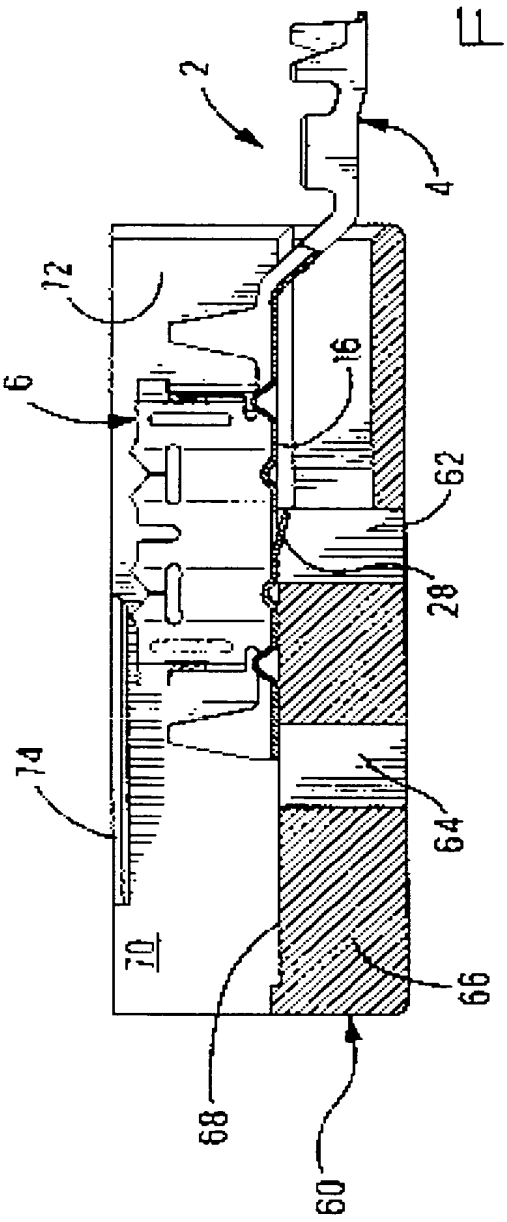

Fig. 5

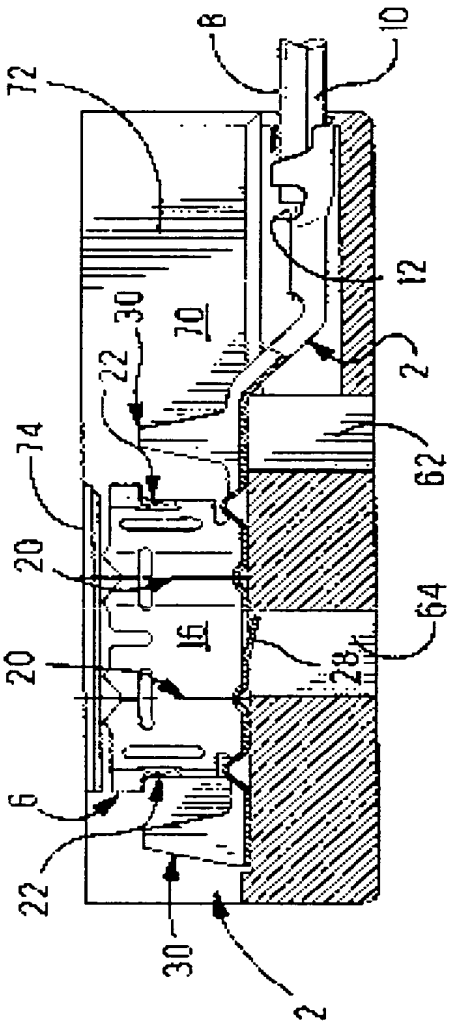

Fig. 6

(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 722 197 A3

(12) EUROPEAN PATENT APPLICATION

(88) Date of publication A3:
21.04.1999 Bulletin 1999/16

(43) Date of publication A2:
17.07.1996 Bulletin 1996/29

(21) Application number: **95119813.4**

(22) Date of filing: **15.12.1995**

(51) Int. Cl.[6]: **H01R 4/24**

(84) Designated Contracting States:
DE ES FR GB IT SE

(30) Priority: **16.01.1995 GB 9500782**

(71) Applicant:
THE WHITAKER CORPORATION
Wilmington, Delaware 19808 (US)

(72) Inventors:
- **Hotea, Gheorghe**
  D-64347 Griesheim (DE)
- **Wittig, Lutz**
  D-63225 Langen (DE)

(74) Representative:
Heinz-Schäfer, Marion
AMP International Enterprises Limited
Ampèrestrasse 3
9323 Steinach (SG) (CH)

(54) Insulation displacement contact for multiple wire sizes

(57) An electrical connector assembly comprising an electrical terminal (2) seated within a housing (60), said terminal (2) including an insulation displacement contact (IDC) section (6) adapted for receiving a multitude of through wire diameters along the length thereof and a conductor engaging section (4) for electrical engagement with a mating wire end (8) where said assembly has a first position (Figure 5) with the terminal (6) in the housing (60) and the IDC section (6) is open for engaging the wire along the length thereof.

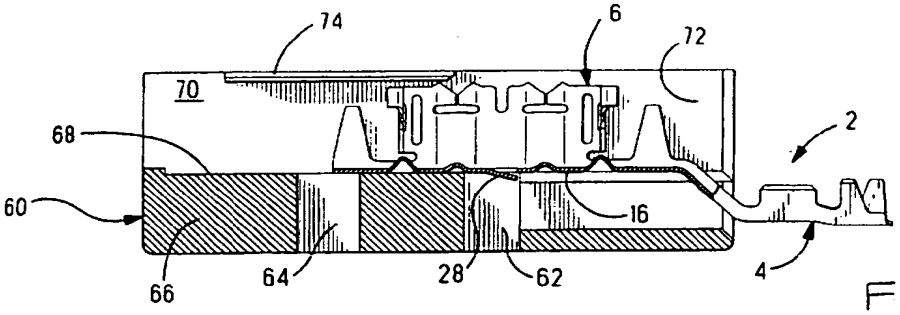

Fig. 5

EP 0 722 197 A3

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 95 11 9813

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
A	US 4 840 578 A (SATO KENSAKU) 20 June 1989 * abstract; claims 1,5; figures 2,5,7,8 *	1,4,5,9	H01R4/24
A	EP 0 600 418 A (WHITAKER CORP) 8 June 1994 * figures 1,2,7,8 *	1,5	
A	US 4 208 083 A (KIRBY EDWARD) 17 June 1980 * figures 5-7,10,11 *	1,3	
A	EP 0 197 642 A (MOLEX INC) 15 October 1986 * figures 1-3 *	1,2	
A	WO 87 02516 A (PANDUIT CORP) 23 April 1987 * figures 1-3 * * page 5, line 12-24 *	1,2	

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

H01R

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	2 March 1999	Durand, F

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& . member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 95 11 9813

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

02-03-1999

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 4840578 A	20-06-1989	JP 1747302 C	25-03-1993
		JP 4024832 B	28-04-1992
		JP 63164178 A	07-07-1988
EP 0600418 A	08-06-1994	DE 69317219 D	09-04-1998
		DE 69317219 T	06-08-1998
		US 5435754 A	25-07-1995
US 4208083 A	17-06-1980	NONE	
EP 0197642 A	15-10-1986	US 4620766 A	04-11-1986
		DE 3682803 A	23-01-1992
		JP 1473849 C	27-12-1988
		JP 61227379 A	09-10-1986
		JP 63023624 B	17-05-1988
WO 8702516 A	23-04-1987	US 4983130 A	08-01-1991
		AU 6540186 A	05-05-1987
		CA 1240748 A	16-08-1988
		DE 3685490 A	02-07-1992
		EP 0240552 A	14-10-1987
		JP 63501046 T	14-04-1988

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

Best Available Copy